

Poster Session 1

Tuesday, January 23, 2001

12:30 – 2:00

Disease Severity Modeled on Two Ordinal Indices in a Prospective Study of Vulvovaginal Candidiasis Among Women with Or at Increased Risk for HIV

Charles M. Heilig (1), Ann Duerr (1), Susan Cu-Uvin (2), Robert S. Klein (3), Anne Rompalo (4), and Jack Sobel (5)

Division of Reproductive Health, National Center for Chronic Disease Control and Health Promotion,
Centers for Disease Control and Prevention (1)
The Miriam Hospital, Brown University (2)
Montefiore Medical Center, Albert Einstein School of Medicine (3)
Johns Hopkins University School of Medicine (4)
Harper Hospital, Wayne State University (5)

OBJECTIVES: To model the severity of vulvovaginal candidiasis (VVC) using two ordinal indices, and to quantify the association of human immunodeficiency virus (HIV) serostatus with each combination of index levels.

METHODS: The first index, yeast growth, was classified into four ordered categories based on *Candida* culture and amount of yeast on Gram stain. The second index was the number of clinical manifestations (vulvovaginal edema, erythema, and discharge). The Cartesian product of these two indices yielded 16 bivariate categories. Each bivariate category also determined an upward-inclusive category constructed from that category together with other categories at or above the same levels of yeast growth and clinical signs. Poisson regression yielded 15 HIV prevalence ratio estimates for each upward-inclusive category, adjusted for within-subject correlation. Additional models estimated prevalence of each upward-inclusive category conditional on lower levels of severity. Sensitivity analyses assessed the robustness of models against distribution choice and link function, confounding, and effect modification.

The data were from the HIV Epidemiology Research Study, a prospective cohort of 871 HIV-infected and 439 high-risk, uninfected women from four US cities.

RESULTS: Compared to uninfected women, HIV-infected women exhibited any yeast growth 44% more often ($p < 0.001$) and at least one sign 14% more often ($p < 0.001$). Vulvovaginal candidiasis (VVC)—defined as the presence of yeast organism and at least one of three clinical signs—occurred 77% more often in women infected with HIV ($p < 0.001$). Among women with some yeast growth, there was no difference by HIV status in prevalence of additional yeast. Similarly, among women with at least one sign, there was no difference by HIV status in prevalence of additional signs. Results did not differ appreciably in binomial models with logit link, and there was no evidence of confounding or effect modification.

CONCLUSION: HIV infection is associated with increased occurrence of all levels of yeast growth, any number of clinical signs, and combined levels of these indices. However, among women with VVC, there is no difference by HIV status in severity of candidiasis as measured by these indices.

Partners for a Healthy Baby Data Tracking System

Kwang-lee Chu
Center for Prevention & EIP, Florida State University

OBJECTIVES: It provides a database system for tracking the use of the Partners for A Healthy Baby curricula and allows home visiting programs, such as Healthy Start, Early Head Start, Healthy Families and others

METHODS: Creating user friendly database system using Filemaker pro relational database software.

RESULTS: Six modules are included in this Data System:

Module 1: Home Visiting Records (HV_Recd): Covers the Partners for a Healthy Baby curricular topics as well as the number and type of family planning services received.

Module 2: Client Recruitment and Family Risk Factors: includes Recruitment, Prenatal Risk Screen (Prenatal), and Infant Risk Screen (Infant).

Recruitment records clients' demographics, employment, education, enrollment and termination date and reasons.

Prenatal is identical to Florida's Healthy Start Prenatal Risk Screen form.

Infant is identical to Florida's Healthy Start Infant Risk Screen Form.

Module 3: Family Progress Review (Progress): records changes in employment, education, household information, mental health status, and other family issues. It also records prenatal, postnatal, family

Module 4: Maternal Health: includes Prenatal Risk Screen (Prenatal) and Prenatal Care Visits (Pren_vst).

Prenatal: same as Prenatal in Module 2.

Pren_vst: records prenatal number and dates of visits to health care providers.

Module 5: Infant & Child Health Care: includes Infant Risk Screen (Infant), Immunization & Well-baby check up (Wellbaby), and Child Health History (Childhlth).

Infant: same as Infant in Module 2.

Wellbaby: records number and dates of dates of immunization and well-baby check ups.

Childhlth: records child health status from birth to 3 years old.

Module 6: Child Development Milestones: Ages and Stages Questionnaire (ASQ) records child development milestones as measured by the ASQ.

CONCLUSION: 1. User-friendly design.

2. Increases data entry reliability.

3. Automatically provides reminder dates for prenatal visits, immunizations, well baby check-ups, and any other dates that may be difficult to keep track of.

4. Field-tested.

Perinatal Case Management and Birth Weight in Georgia, 1994-1996

Mohamed G Qayad

Epidemiology Branch, Georgia Division of Public Health

OBJECTIVES: 1. To determine if Perinatal Case Management (PCM) affects the birth weight of infants born to Medicaid clients. 2. To estimate the magnitude of the effect of PCM on the birth weight of infants born to PCM mothers

METHODS: We used Georgia's live births for 1994-1996, and analyzed 150,055 singleton Medicaid births. We categorized the birth weight into low birth weight (<2,500 grams) and normal birth weight ($\geq 2,500$ grams). This was used as the outcome variable for the logistic regression analysis to assess the risk of low birth weight. We used birth weight as the outcome variable for linear regression analysis to estimate the average weight difference between PCM and non-PCM clients. Mother's race, age, education, smoking, marital status, and parity were controlled in both models. These variables and the PCM were binary categorical variables. We used Wald statistics to assess the statistical significance of the interactions between PCM and these variables.

RESULTS: Among Medicaid singleton births, 61,736 (41%) were PCM clients during 1994-1996. The number and percent of Medicaid singleton births with low birth weight was 5,373 (8.7%) for PCM and 8,491 (9.6%) for non-PCM. PCM clients had a lower risk of low birth weight than non-PCM [odds ratio (OR)=0.90 (95% CI, 0.86-0.92)]. When race, education, age, marital status, smoking and parity were controlled, the risk declined further [OR=0.86 (95% CI, 0.82-0.89)]. The average birth weight for PCM client babies was slightly higher (3,219 grams) than that for non-PCM babies (3,212 grams). When race, education, age, marital status, smoking and parity were controlled, PCM client babies were 15 grams heavier than non-PCM client babies were. PCM interacts with marital status and parity.

CONCLUSION: PCM is associated with a 14% reduction in the risk of low birth weight, and is associated with a 15 grams increase in the average birth weight. Primary care providers should be encouraged to participate in the program to maximize its benefits.

A Method for Predicting Inpatient Cost in Hospital

Jianli Li and John D. Hawkins
St. Michael's Hospital, University of Toronto

OBJECTIVES: The inpatient cost estimation based on the diagnoses, procedures, and various clinical and demographic factors of patients is important for the hospital resources and budget planning. The objective of this study was to develop a composite model to estimate the inpatient costs during their stay in hospital and design a data mart, which can support the modeling and online prediction.

METHODS: The data for CABG (Coronary Artery Bypass Graft) patients from 1997 to 1999 were collected from several databases and investigated. A composite model was used to explore the relationship between cost, and lengths of stay during different episodes in care process, patients' characteristics and their interactions. The conditional distribution of length of stay with specific major intensity factors was further studied. Given the specific condition of patient, the estimated cost was obtained from the estimated components of lengths of stay and several factors.

RESULTS: The models for specific CMGs (Case Mix Group) or DRGs (Diagnosis Related Group) were found, which reveal the relationship (multivariate regression) between cost, and lengths of stay and specific factors, such as left ventricular function, urgency code, gender and age ($\text{Adj. } R > 0.9$). The conditional expectations of the lengths of stay were estimated given patient's significant intensity factors ($P < 0.01$) as well. The expected costs under various conditions of patients were estimated.

CONCLUSION: The distribution of inpatient cost is complicated, which may consist of several sub-distributions with different weights depending on some factors. This study showed the potential of applying the lifetime models and multivariate regression models in the inpatient cost prediction and comparison with factor adjustment.

Estimation of Vaccine Efficacy from Household Data

Xiaohong Mao Davis and Michael J. Haber

Department of Biostatistics, Rollins School of Public Health, Emory University

OBJECTIVES: Develop methods for estimation of the vaccine efficacy for susceptibility and infectiousness when the vaccine affects both the susceptibility and infectiousness of vaccinated individuals using household data. Compare different study designs, especially compare the household designs to a study on unrelated individuals.

METHODS: We developed a model that is based on household final attack rate data. The parameters in the model are transmission probabilities and reduction to these probabilities due to vaccination. The model was applied to a San Diego daycare influenza vaccine trial data set. For comparing different study designs, simulations will be conducted for three different designs: 1. Sample n households, vaccinate half the members in each household; 2. Sample n households, vaccinate everyone in half of the n households; 3. Sample the same number of unrelated individuals from the population, vaccinate half of the sample.

RESULTS: The San Diego daycare influenza vaccine trial data set had 122 households with a total of 455 individuals. The mean household size was 3.7 (standard deviation 1.273). Among the 455 individuals, 160 (35.2%) were vaccinated. Two hundred seventy-one out of 455 individuals were infected, where "infection" is defined as "any respiratory illness" for the purpose of calculation. The attack rate among the vaccinated is 0.631 (101/160). The attack rate among the unvaccinated is 0.576 (170/295). The vaccine efficacy based on attack rates ($VR(AR)$) is thus -0.0959 in this data. The application of our model gives estimates (with standard errors in parentheses) as follows: the probability that an unvaccinated person becomes infected from the community during the course of the epidemic is 0.488 (0.043); the probability that an unvaccinated person is infected from an unvaccinated household member while the latter is infectious is 0.127 (0.043); reduction of the transmission probability to a vaccinated susceptible due to vaccination is 1.128 (0.106); and reduction of the transmission probability from a vaccinated infectious person due to vaccination is 0.548 (0.591). The estimate of vaccine efficacy for susceptibility is -0.128 (0.106) and of vaccine efficacy for infectiousness is 0.452 (0.591).

CONCLUSION: The model we developed provides estimates of parameters that have more direct epidemiological interpretation of the vaccine effects than traditional models in this area. Computationally, our model has the advantage over the earlier models of the same type by decreasing the number of parameters to be estimated. Household data should be used for estimating vaccine efficacy for susceptibility and infectiousness because it contains information about the vaccination and infection status of each member of the household.

Latent Growth Curve Modeling of Unbalanced Data Collected During a Refugee Crisis

Samuel F. Posner (1), Ann Duerr (1), and Mark Gilbert (2)

Division of Reproductive Health, National Center for Chronic Disease Control and Health Promotion,
Centers for Disease Control and Prevention (1)

University of Ottawa Medical School (2)

OBJECTIVES: The objective of this analysis was to identify a method for the analysis to model change in weight of prospective data collected during an acute refugee crisis. In the 1994 Rwandan refugee crisis approximately 800,000 Rwandans crossed border into Zaire (Democratic Republic of Congo) during a two day period. Collecting data during this crisis was difficult and resulted in a very complex data structure.

METHODS: Data from multiple visits was collected on weight and demographic data from lower and higher-risk children enrolled in a food support program. Because the number and time between data collection points was highly variable, Latent Growth Curve (LGC) analysis was used to model children's weight gain over time using a Proc Mixed. Model fitting was conducted in three stages. First, a model with linear and non-linear weight gain terms and risk group was fit to the data. Second, model one terms and one of a list of demographic variables were modeled. Third, a model with weight gain, risk group and factors significant in the second model was fit to the data.

RESULTS: Data from 1174 children with 2 to 35 visits resulting in 7968 valid observations was analyzed. A repeated-measures analysis was used that treated each child as an independent observation. Standard errors for all parameters were estimated based on the estimated variance-covariance matrix computed using the 'sandwich' estimator. Models specifying different covariance structures were fit to the data. Auto-regressive covariance structures provided the best fit to the data with the first-order auto regressive moving average being the best. The initial model for weight gain found that there was a significant difference in estimated mean weight by risk group as well as significant linear, quadratic and cubic kilograms per month weight gain terms. There was no significant difference in weight gain by risk group. In the second analysis significant terms included having at least one blanket at baseline, child's age, illness at a visit and month of enrollment. The only interaction significant was between child's age and linear weight gain. In the third model weight change (linear, quadratic and cubic terms), risk group, having at least one blanket, child's age, illness at a visit, month of enrollment and interaction terms between time (linear rate of weight change) and child's age and time and month of enrollment remained significant.

CONCLUSION: LGC Analysis was able to accommodate unbalanced data and take advantage of all available information from program participants. LGC analysis accommodated linear and non-linear terms as well as interactions between time and environmental factors. Because of the complex nature of the data structure, LGC analysis was clearly the preferable analytic method.

Evaluation of a Volunteer Sampling Method in a Controlled Intervention Trial in Seventeen Alaskan Villages

Dana A. Bruden, T.W. Hennessy, D.A. Hurlburt, L.R. Bulkow, J.C. Butler and K.M. Petersen
Arctic Investigations Program, National Center for Infectious Diseases, Centers for Disease Control and Prevention

OBJECTIVES: Increased antibiotic use has been associated with increased antibiotic resistance in the common respiratory pathogen, *Streptococcus pneumoniae*. In 1998 and 1999, we conducted a controlled intervention in 17 villages in Alaska to determine if carriage of penicillin-nonsusceptible *S. pneumoniae* could be reduced by education about judicious use of antibiotics or by an increased amoxicillin doseage. To assess the impact of the interventions we cultured nasopharyngeal swabs on a volunteer sample of residents within villages. Here we compare characteristics of the participants and non-participants and report on the effect of the volunteer sampling method on evaluation of the main study objective.

METHODS: Prior to and after the interventions, nasopharyngeal swab specimens were collected from volunteer participants and cultured for *S. pneumoniae*. Medical records of all village residents, including non-participants were reviewed concurrently to determine the number of clinic visits and antibiotic courses prescribed during a 6-month period from October through March. We compared age, antibiotic courses, and clinic visits between participants and non-participants using a generalized linear model. To evaluate the sampling technique in relation to our main study objective, we tested interaction terms involving year and participation.

RESULTS: Over both years of the study, 11,794 medical records were reviewed and 3,915 nasopharyngeal swabs were obtained from volunteer participants. In 1998, the average age of participants was 22.9 years, which was significantly younger than 28.2 years for non-participants ($P < 0.05$). Of those who participated, 81% used the clinic in the previous 6 months with an average of 3.3 clinic visits. For non-participants, 68% had been to the clinic with an average of 2.4 clinic visits. Forty-seven percent of participants had been prescribed antibiotics and had taken a mean of 1.0 courses. For non-participants, 35% had been prescribed antibiotics with a mean of 0.67 courses per person. After controlling for age, there were significant differences in the numbers of antibiotic courses ($P < 0.01$) and clinic visits ($P < 0.01$) between participants and non-participants. The interaction term between participation and year was not significant in either the model for clinic visits ($P = 0.36$) nor the number of antibiotic courses ($P = 0.20$).

CONCLUSION: In this intervention we used a volunteer or convenience sampling method and found that participants were younger, had more medical clinic visits and more antibiotic use than nonparticipants. However, differences between participants and non-participants were similar in both years of the study allowing for a comparison of the main study outcome before and after the intervention.

Laboratory Quality Control for Studies with Measurements from Multiple Instruments

Samuel P. Caudill

Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention

OBJECTIVES: Develop an automated statistical Quality Control (QC) system to provide uniform monitoring of multiple variables measured by more than one measurement system so that measurements obtained from different systems can be combined.

METHODS: To obtain QC limits that reflect the variation due to the interchangeable modular components of the measurement systems, N characterization runs for each of K sets of measurement systems are performed (separately for each variable and QC pool). Each set of systems is configured with modular components chosen randomly from several lots of component parts. The QC limits obtained for each variable/pool are then used for separate monitoring of each of the measurement systems during routine analyses of study specimens. QC limits applied separately to each system are then used to determine which, if any, system is not performing according to specifications.

RESULTS: The Division of Laboratory Sciences (DLS) in the National Center for Environmental Health (NCEH) measures 13 analytes (fat-soluble vitamins and carotenoids) in serum collected from about 5,000 people per year as part of the National Health and Nutrition Examination Survey (NHANES). The measurements are made using a high performance liquid chromatography (HPLC) method with photo diode array (PDA) detection. Because of the large number of specimens, the complex analytical method, and the possibility of instrument failure due to failure of any one of many component parts, three different HPLC systems are used. In addition, to assure that the systems are performing adequately across a wide range of concentrations, three separate control pools are monitored, with concentrations of the 13 analytes at low, medium, and high levels. The proposed QC system is being used effectively to generate one uniform set of QC limits for each analyte/pool while at the same time insuring separate monitoring of each system.

CONCLUSION: In a traditional QC setting it would be preferable to compute control limits separately for each system/analyte/pool. Because of the need for comparability of measurements across all NHANES specimens which are measured over a course of several years and because the three systems are essentially identical with interchangeable modular components, we chose to compute one set of QC limits for each analyte/pool to be applied separately to each system/analyte/pool. This approach which has been automated using SAS software insures that each measurement system is monitored separately so that problems with any one system will not go undetected. Because the same QC limits are applicable to each measurement system, study specimens measured by different systems can be combined for analysis without major concern about measurement system bias.

Cognitive Testing of the Medicare Quality Monitoring System Survey (MQMSS)

Lisa Lee (1), Mary Hess (1), Susan L. Arday (2), and Mary Grace Kovar (1)
National Opinion Research Center (1)
Health Care Financing Administration (2)

OBJECTIVES: The objective of Phase I of this study was to interview elderly respondents on the content and interpretation of selected questions in the draft MQMSS instrument. Results and lessons learned from the first phase informed changes to the instrument before it was tested under mail and telephone administrative conditions in Phase II.

METHODS: The testing of the MQMSS occurred in two phases. In Phase I, questions that could pose problems of comprehension, recall or sensitivity were selected for cognitive testing. Eight interviewers conducted a total of 30 in-person interviews. In Phase II, we tested whether revisions to the questionnaire were effective and tested mail and telephone modes of survey administration. Forty respondents completed the survey by telephone or mail. Following completion of the survey, the cognitive interviewers conducted debriefing sessions with each respondent. The respondents who participated in the MQMSS testing were Medicare beneficiaries recruited primarily from senior centers in the Chicago area. Several respondents were nonnative speakers of English; 29% of respondents had chronic health problems. The respondents ranged in age from 65 to 93 (40% ages 65 - 74, 47% ages 75 - 84, and 13% age 85 and over) and represented a wide demographic spectrum.

RESULTS: Phase I revealed a number of questions in which respondents experienced comprehension problems because of unfamiliar terminology. With other questions, respondents tended to give narrative answers that did not directly address the question that was asked. When asked to explain how they remembered certain time periods, respondents generally had difficulty explaining but felt their recall was quite accurate. The Phase II testing suggested that the revisions made to the questionnaire after Phase I were effective. We also found that respondents are not always able to judge accurately their ability to complete the survey without help. Some respondents in the mail mode did not complete the survey correctly, although most did not report any difficulties during debriefing. In addition, some nonnative English speakers who felt they could complete the survey found they could not do so without a translator.

CONCLUSION: The cognitive testing of the MQMSS questionnaire yielded improvements to selected items that appeared problematic for elderly respondents. In addition, testing of the mail and telephone surveys yielded valuable insights into the problems elderly respondents could face in the national implementation of the survey and ways to address those problems.

Assessing the Quality of Linkages in Maternally-linked Birth Records Data Sets

Jack K. Leiss
Analytical Sciences, Inc.

OBJECTIVES: To develop approaches and measures for assessing the quality of linkages in maternally-linked birth records data sets

METHODS: Births to the same woman were linked in North Carolina birth and fetal death records for 1988-1997 (n=1,019,811) using probabilistic matching as implemented by the Automatch software. The relative utility of internal vs. external validation was assessed qualitatively. Four methods of obtaining external files for validating the maternally-linked file were explored. The four methods were conducting a population survey, using hospital birth log records, and using administrative records from Medicaid and from WIC. Measures for evaluating the maternal linkages using external files were developed. For measures of correct links, we calculated the proportion of records in the maternally-linked file that were linked to all of the other records with which they were supposed to be linked, as indicated by the external file; and the proportion of maternal sets (i.e., sibling sets) in the maternally-linked file that included all of the members of the set, as indicated by the external file. For measures of incorrect links, we calculated the proportion of records in the external file that were linked in the maternally-linked file to any other record with which they were not supposed to be linked, and the proportion of maternal sets from the external file for which at least one record was linked in the maternally-linked file with a record from a different set.

RESULTS: Comparison of the relative strengths and weaknesses of internal vs. external validation suggested that internal validation had several weaknesses that were not characteristic of external validation. External files were obtained from hospital birth log records and from WIC records, but not from the population survey or Medicaid records. Using the hospital file as the external data set, 87% of the records in the maternally-linked file were linked to all of the other birth records with which they were supposed to be linked, and 10% of the records in the birth certificate file were not linked to any other record with which they were supposed to be linked; 80% of the sets in the external file were complete sets in the maternally-linked file, and 9% of the sets in the external file were completely unlinked in the birth certificate file. The comparable numbers using the WIC external file were 50%, 40%, 50%, and 35%, respectively. All measures of incorrect links were around 1%.

CONCLUSION: The imperfect quality of external files compromises their usefulness for evaluating maternal linkages. Future efforts should focus on developing techniques for characterizing external files and their utility for this purpose. Improved methods of internal validation should be developed. Methods for evaluating the effect of imperfect linkages on analyses of the data are also needed.

Reclassify Risk Groups in a Large Cohort Using Classification Trees to Assess Better Cardiovascular Guidelines in Different Ethnic Regions

Chee Jen Chang (1), Chau Chung Wu (1), Shen Jang Fann (2), and Yuan Teh Lee (1)
National Taiwan University Hospital (1)
Academia Sinica (2)

OBJECTIVES: Lowering low density lipoproteins (LDL) is considered as the primary target of cholesterol-lowering therapy recommended by the National Cholesterol Education Program in USA and also in Taiwan. Recent interests in classifying dyslipidemic patients using NCEP guideline have challenged physicians in Taiwan looking for their own by using local data due to the nature ethnicity difference. Two criteria to identify risk groups utilizing classification tree are presented. This study is to demonstrate such procedure can help clinicians identifying the patients who need more aggressive treatment in a more effective manner.

METHODS: Baseline data from Chin-Shan Community Cardiovascular Cohort in Taiwan (CCCC) was used in the data mining procedure to provide a classification tree map that identified homogeneous risk groups. CCCC, a cohort consisting of 3602 residents aged 35+ was conducted since 1990 in a suburban 20 miles north of Taipei metropolitan. Only the baseline data such as cardiovascular diseases (CVD), demographic and biochemical variables were used in data mining. Using the results from this classification tree map in CART has enabled us to categorize the participants into more homogeneous risk groups. New criteria were then proposed from the physicians after carefully examining the tree map. Analyses were then performed according to each of the "hypothetical" grouping criteria, the current NCEP and EAP guidelines. Relative risk (RR) and its 95% confidence interval for five-year CVD morbidity, mortality, and worsening condition were thus analyzed.

RESULTS: Two proposals derived from the statistical procedure were compared to the NCEP and EAS guidelines. Relative risk of 5 year CVD morbidity and mortality were calculated. These were done as if the participants were classified using each of the 4 possible guidelines. Probabilities in categorizing subjects into risk group were then tested and showed statistically significant among the proposed and the two existing guidelines. It is suggested that the relative risk for all 4 criteria is statistically significant away from unity. In the event of CVD morbidity and mortality, relative risk is the greatest if the participants were categorized using the first proposal derived from the data mining procedure.

CONCLUSION: Classification tree data mining using CCCC baseline data demonstrated a better predictability in identifying risk group. Two proposals derived from this procedure have better powers in looking for the "right" local patients than the existing NCEP and EAS guideline. This also suggests a new statistical approach in supporting to set up the local guideline for treating dyslipidemia in different ethnic populations.

A Six Equation Model and Cost-Containment in Medicaid Hospital Programs

Etienne Pracht

Department of Health Policy and Management, University of South Florida

OBJECTIVES: The hospital industry has traditionally claimed a relatively large share of the nation's health care expenditures, and, as a result, has been subjected to numerous cost containment measures. The wide latitude of individual states to shape their own Medicaid programs has led to substantial variation and a unique environment for study. This paper concentrates on the estimation procedure of a six equation model to examine the relative significance of the various types of hospital cost containment policies in Medicaid.

METHODS: The provision of inpatient hospital services is determined by numerous factors interacting in a complicated system of cause and effect. Within the context of hospital cost containment, these factors may be divided into endogenously determined government policy variables and exogenously determined control factors. The former category may be further divided into three main types: (1) direct controls over prices and utilization, such as prospective payment systems (PPS) or coverage limitations; (2) indirect controls over utilization which manipulate eligibility standards; and (3) market oriented managed care principles, which capitalize on the financial incentive structures associated with prepaid health plans developed in the private sector.

The six equations of the model estimate the level of expenditures, the probability of a DRG based PPS, the probability of a rate of increase control PPS, the probability of coverage limitations, the enrollment in managed care programs, and the size of the demand population. To estimate the parameters of this simultaneous equations system, which includes continuous, dichotomous, and censored endogenous variables, a two stage estimator and the bootstrap technique are employed.

RESULTS: The bootstrap standard errors for the policy variables were smaller by magnitudes ranging from 0.67 percent to 2.1 percent, causing substantial increases in associated t-statistics. .

CONCLUSION: The main implication of the results is that the use of single equation models may result in underestimation of the impact of cost-containment policies.

Metric and Categorical Indicator Latent Class Models with Missing Data

Brian P. Flaherty (1) and Gary A. Giovino (2)

The Methodology Center, College of Health and Human Development, The Pennsylvania State University
(1)

Department of Cancer Prevention, Epidemiology, and Biostatistics, Roswell Park Cancer Institute (2)

OBJECTIVES: To develop a latent class model capable of handling both metric and nominal indicators. The model also handles missing data among the indicators. An analysis of adolescent cigarette smoking behavior is presented.

METHODS: Data are from the first wave of the Teenage Attitudes and Practices Survey. Items measuring regular and recent use, as well as smoking initiation, are included. The model is estimated with an EM algorithm.

RESULTS: Preliminary analyses indicate that a two-class model describes the data. One class maps onto an experimenter class, comprising about 74% of the sample. This class was most likely to say no to the smoked 100 cigarettes, smoked every day for a month, and smoked in the past seven days items. It was most likely that this group did not smoke on any of the past 30 days, but about 25% did smoke on fewer than 30 days in the past month. The probability that someone in this group smoked every day in the past month was essentially zero. The mean number of cigarettes smoked in the past seven days was also essentially zero. Regular smokers form the other class, about 26% of the sample. These adolescents were likely to have smoked 100 or more cigarettes, and to have smoked every day for a month. They were also almost certain to have smoked in the past seven days. Thirty-four percent of this class smoked on fewer than 30 days in the past month and 66% percent smoked every day of the past month. The average number of cigarettes people in this class smoked during the past seven days was 57.

CONCLUSION: A latent class model utilizing both categorical and continuous indicators has been presented. Treating metric variables as such keeps information in the analysis that would be lost by categorizing. Furthermore, the problem of the choice of cut points is eliminated. Substantively, the results fit well with previous research using both manifest and latent variables. Two well-defined groups of smokers were found. An interesting result was that about 25% of the experimenter class had smoked in the past 30 days. This could have ramifications on smoker classification procedures using recent use as a proxy for regular use.

Some limitations of this work are that standard errors are not obtained and the complex sample structure of the TAPS data has been ignored. Future work will address these issues.

Confidence Intervals for an Age Adjusted Rate

Moshe Braner
Health Surveillance, Vermont Department of Health

OBJECTIVES: Develop a simple, theory-based method for computing an approximate, but fairly accurate, asymmetric, confidence interval (CI) for an age-adjusted rate.

METHODS: Review of meaning of CI, and the derivation of Fleiss' formula for the case of a simple proportion. This approach is extended, based on the assumptions that we are only interested in variation in the overall rate, while the age distribution of the events does not vary much, and that the number of events within each age group approximately follows the Poisson distribution. A second, likelihood-ratio-based, method is also derived.

RESULTS: The computed CIs are very close to those computed based on the gamma distribution. Preliminary simulation results show that the coverage probabilities of confidence intervals thus computed are slightly conservative. The alternative likelihood-ratio-based method yields similar results, but requires iterative solution and a threshold likelihood ratio that is about double what one would expect.

CONCLUSION: A simple direct formula, similar to Fleiss' formula for the case of a simple proportion, is available for the purpose of computing an approximate, asymmetric, confidence interval for an age-adjusted rate.

Poster Session 2

Wednesday, January 24, 2001

12:30 – 2:00

Reliability of the Youth Risk Behavior Survey Questionnaire and Validity of Self-Reported Height and Weight Among High School Students

Nancy D. Brener, Laura Kann, Steven A. Kinchen, and Timothy McManus

Division of Adolescent and School Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention

OBJECTIVES: To determine the test-retest reliability of the Youth Risk Behavior Survey (YRBS) questionnaire, which measures health-risk behaviors of high school students nationwide, and to assess the validity of self-reported height and weight among high school students.

METHODS: The YRBS questionnaire was administered to 4619 students in grades 9 through 12 on two occasions approximately two weeks apart. Between administrations, 55.3% of these students were weighed and measured using a standard protocol. A kappa statistic was calculated for each of 72 self-report items, group prevalence estimates were compared across the two testing occasions, and correlations and differences were calculated comparing self-reported with measured height and weight.

RESULTS: Kappas ranged from 23.6% to 90.5%, with 47.2% of items demonstrating "substantial" or higher reliability ($\kappa > 61\%$). About one-fifth of items (22.2%) had significantly different prevalence estimates at the two testing administrations, and 13.9% of items had kappas $< 61\%$ and significantly difference prevalence estimates at the two testing administrations. Mean kappas did not differ significantly by respondent sex, grade, or race/ethnicity. Items related to tobacco use demonstrated the highest reliability; items related to dietary behaviors and physical activity demonstrated the lowest reliability. Self-reported height and weight were highly correlated with measured height and weight (r 's = .88 and .95, respectively), but, on average, students overreported their height by 2.8 inches and underreported their weight by 3.3 pounds.

CONCLUSION: While items varied in their test-retest reliability, group prevalence estimates generally remained consistent between testing administrations. In terms of height and weight, self-reports did not vary substantially from actual measurements.

A Study of Item-Response Bias on the Aggressive Behavior Dimension of the Child Behavior Checklist Among a National Representative Sample of Hispanic and Non-Hispanic Youths

Akihito Kamata and Jorge Delva
Florida State University

OBJECTIVES: This study seeks to demonstrate that youths of Hispanic and non-Hispanic backgrounds will differentially endorse items of the Child Behavior Checklist (CBCL) Aggressive Behavior dimension. The CBCL is a widely used instrument that measures behavioral and mental health problems among youths (Achenbach, 1991). The CBCL has been found to have adequate psychometric properties across population groups, however, to our knowledge, potential item-response bias across individuals in these groups has not been investigated.

METHODS: Differential item functioning (DIF) was utilized to measure if the endorsement of items on the CBCL's Aggressive Behavior dimension differed as a function of a youth's racial/ethnic background. DIF is an observation that a test item displays different statistical properties for different groups (Angoff, 1993; Holland & Thayer, 1988; Thissen, Steinberg, & Gerrard, 1986; Muraki & Engelhart, 1982). Typically, DIF is observed when an item behaves differently between groups, given the same level of latent trait. If DIF is observed, it could be an indication of a biased item.

We used data from the 1996 National Household Survey on Drug Abuse (NHSDA). The NHSDA is primarily designed to provide cross-sectional information about patterns of drug use, risk factors, mental health status, among household residents of the United States, aged 12 years and older (Substance Abuse Mental Health Services Administration (SAMHSA), 1998). The NHSDA employs a multi-stage area probability sampling design to survey civilians, aged 12 years and older, living in the U.S. (SAMHSA, 1998). In our study we focus on differences between 4538 youth of Hispanic and non-Hispanic backgrounds ages 12-17. Respondents' racial/ethnic background was measured via self-report. The Aggressive Behavior Dimension consists of 20 statements regarding aggressive behaviors where respondents are asked to answer whether the item is 1 = not true, 2 = somewhat or sometimes true, or 3 = very true or often true. The data were analyzed using a series of DIF analyses conducted with the ConQuest software (Wu, Adams & Wilson, 1998).

RESULTS: Results of the DIF analyses indicated that Hispanic youths were significantly less likely to be aggressive than non-Hispanic youths and that they answered four of the 20 items differently, given the same latent level of aggressiveness. Hispanics tended to score lower than non-Hispanics on the items "I brag", "I am jealous of others", and "I am stubborn" and higher on the item "I scream a lot." Also, we found that Hispanic and non-Hispanic youths have different step structure in their responses to the items. For example, Hispanics needed to be more aggressive than non-Hispanics to answer "very true or often true" for the items "I am jealous of others" and "I scream a lot."

CONCLUSION: Not all CBCL Aggressive Behaviors items are good indicators of the construct it seeks to measure for Hispanic and non-Hispanic youths. Socio-cultural differences between groups may explain the findings. To obtain valid estimates of behavioral constructs researchers should place greater attention to the potential item-response biases that may exist across population groups above and beyond the standard evaluation of the instrument's psychometric properties. Further investigation of item-response bias among other population groups is warranted as well as the study of factors that may account for these differences.

**Correlates of Hospital Length of Stay and Cost:
Application of a Multivariate Model for Health Care Utilization and Cost**

Elena Polverejan, Joseph C. Gardiner, Margaret Holmes-Rovner, and David Rovner
Division of Biostatistics, Department of Epidemiology, Michigan State University

OBJECTIVES: To estimate summary measures and assess the correlates of health care utilization and cost, from a statistical model that adjusts for correlation between these outcomes. Determining the correlates of hospital length of stay (LOS) and cost among patients with major medical interventions is useful for resource allocation decisions and cost-containment practices.

METHODS: We develop a bivariate semiparametric model for utilization, as measured by length of stay (LOS), and in-hospital cost. Separate Cox regression models for these outcomes are applied to incorporate covariates. Both LOS and cost are regarded as incompletely observed among in-hospital deaths. By adapting methods designed for analyzing multiple failure times, the robust covariance of the regression coefficients is estimated, thereby accounting for the correlation between LOS and cost. For specified covariate profiles, confidence intervals for median LOS and median cost are obtained as functions of the underlying regression coefficients.

When comparing two competing health care interventions, the method is used to estimate a comparative summary measure of utilization and cost, the ratio of the incremental median cost to the incremental median LOS.

We applied our method to analyze LOS and hospital charges in 360 patients hospitalized for acute myocardial infarction in two urban hospitals in Michigan. The final model contained age at admission, race, hospital, ejection fraction, comorbidity, and the cardiac procedure performed. Procedures were: cardiac catheterization, percutaneous transluminal coronary angioplasty (PTCA), coronary artery bypass graft surgery (CABG), or none (medications only).

RESULTS: Overall, there was no pattern in the 95% confidence intervals for median charges and LOS when computed under the bivariate model that accounts for correlation, compared to separate univariate models that assume LOS and charges are independent. However, wider confidence intervals were obtained for CABG and PTCA with higher comorbidity.

CONCLUSION: For relatively short hospital stays when only total charges are available, the multivariate model provides a flexible approach to analyze the simultaneous impact of covariates on both LOS and charge, and to derive estimates of summary measures of health care utilization without explicitly specifying their joint distribution.

Analytic Methods for Community-Based Assessments

Tim E. Aldrich, Natalie Scruggs, and Bill Bartoli

Epidemiology Bureau, South Carolina Department Health and Environmental Control

OBJECTIVES: To develop statistical methods to evaluate evidence of intervention effects on communities, using ecological assessments between geographic scales.

METHODS: We performed multiple ecological analyses to evaluate consistency between risk factor prevalence rates for differing scales of effect. Our approach begins with logistic analyses with geographic referencing (e.g., county as the unit of analysis) to identify high-risk populations. These groups may be at-risk of disease, or for a change in behavior, e.g., increased exercising. We use statistically significant differences to identify principal risk distributions, establish the magnitude of effect sizes, and identify a set of health-related correlates, we term this analysis: Tier Ia. These provide a model for local comparison in a search for similar effects in a small population.

We next turn to local data analyses [small area] for a measure to assess whether corresponding local differences can be validated. This process, termed Tier Ib, involves "borrowing power" from the larger analysis to establish precise local indicators. One aid for these local forecasts has been a periodic finding of very large differences e.g., greater than five-fold differences. With these local assessments to confirm the Tier Ia relationships, we do not rely on 0.05 levels of significance alone for decision-making, or even for pattern identification. We rely on the direction of effects measured, and the magnitude of effects, in a manner similar to the approach used with meta-analyses.

Finally, with local intervention programs, still there may not be sufficient statistical precision to evaluate small population impacts (e.g., locus of control issues), or personal perspectives (e.g., evidence of attitude change). Local data collection efforts may be mounted by community-based collaborators, termed Tier II. Use of consistent questions with these surveys assures comparability of data formatting. Planning this portion of the analytic design preferably involves participation by the local community to select indicators for the target behaviors. These analyses permit very subtle assessments of correlates of behavior change that can affirm a local impact, even when the target behavior change is not measured directly. These three levels-of-scale assessments often rely on conventional goodness-of-fit chi-square testing.

RESULTS: With these techniques we have described evidence of local community changes in risk factors. Examples for presentation will include in-home prevention services, diabetes risk, and support for our local REACH 2010 project.

CONCLUSION: Ecological assessments between geographic scales are a productive means for statistical support and assessment with community-based programs and local intervention activities.

Statistical Process Control

Shaila Chilappagari (1), Youjie Huang (1), Tim E. Aldrich (2), Laura C. Sanders (1), and Susan Bolick-Aldrich (1)

Bureau of Epidemiology, South Carolina Department of Health and Environmental Control (1)
Preventive Medicine, Department of Family and Preventive Medicine, University of South Carolina School of Medicine (2)

OBJECTIVES: This project aimed to develop a statistical solution for monitoring the completeness and timeliness of population-based disease reporting.

METHODS: The proposed solution is built on an industrial process that has longed relied on statistical methods for recognition of defective units or production difficulties. Recent literature has posed several innovative solutions for monitoring completeness and timeliness of reportable disease registration using statistical methods. We applied a battery of these methods to prostate cancer incidence reporting in South Carolina.

The population-based central cancer registry has a responsibility for complete capture of all new diagnoses of this disease. For a variety of reasons, under-reporting has been suspected (e.g., outpatient diagnosis and therapy, cases being managed by watchful waiting so not therapy is involved to provide an institutional record). The suspected under-reporting is not uniform, so population patterns are evident. This project used the battery of statistical process analyses (e.g., serial proportional testing; CuSum, and internal consistency checks) to assess patterns of delayed or incomplete reporting. Spatial methods are central for this application as the state acts as its own standard. Then progressively smaller regions of the state are studied for 'difference' to identify sources of under-reporting, or delayed reporting. These methods have an attractive alternate application. Using the inverse logic, patterns for excess disease occurrence may be recognized for identifying high-risk populations.

RESULTS: Prostate cancer reporting showed several 'low' submission areas within the state. Field follow-back will be needed to ascertain whether these were the result of inferior case-finding, or a population who was served disproportionately as out patients [a difficult case set to ascertain]. Pathology-based reporting is being implemented to curtail this potential weakness with reporting. Model analyses and illustrative maps will be presented a part of this paper.

CONCLUSION: Statistical process controls are useful quality assurance measures for population-based disease registration.

Serial Tracking of Outbreak Emergence

Tim E. Aldrich (1), Nicol M.I. Black, (2), and J. Wanzer Drane (3)

Bureau of Epidemiology, South Carolina Department Health and Environmental Control (1)

Public Health Laboratory System (2)

University of South Carolina School of Public Health (3)

OBJECTIVES: This presentation describes a surveillance system for monitoring the emergence of infectious disease outbreaks. The sequential system expressly addresses the obstacle of misclassification of cases, or the failure to recognize related events, by an innovative solution to uncertainty.

METHODS: A software package is being developed in Newcastle for monitoring water-borne disease, it is addressing the obstacle to outbreak recognition posed by incomplete case work-up, or erroneous diagnosis through an innovative application of a belief model. With this belief hierarchy, any object in the data base, including unclassified diagnoses, or uncertain classification is assigned a scale of confidence. This confidence score is then manipulated iteratively with the spatial and temporal configuration of cases to optimize the potential for detection of an emerging outbreak.

A battery of statistical methods is used for testing the spatial and temporal patterns, drawing conventional space-time disease clustering solutions. The serial analyses with varying confidence levels provide a sequential logic of possible, probable, and definite determinations. Depending on a variety of characteristics, e.g., spatial aggregation, consistency of demographic traits, or severity of the illness, a hierarchy of reactions may be developed. This tiered decision process works so that candidate outbreak configurations may be distinguished and referred for evaluation with clinical judgment, even as the series of events are accruing. The objective is real-time surveillance; the provision of a pending report is euphemistically referred to as the 'night watchman' as the computation runs overnight. The surveillance system software receives and scores serial disease reports. Then, optimizing solutions are modeled to provide potential scenarios of linked cases. Critical to the operation is a certainty of all incidents being reported.

RESULTS: Considerable efforts for compliance with reporting will be described, as well as linkages with divergent, but related data sources (e.g., hospital, ER attendance, pharmacy sales, school absenteeism records). Such concordance between data sources will be illustrated for their value when considering a tenuous 'watchman' alert. The utility of such confidence-weighted data reports will be illustrated with software demonstrations.

CONCLUSION: Surveillance for emerging infectious disease outbreaks must have a solution for dealing with uncertainty in case classification. It is the very nature of such emerging disease surveillance to have cases that are not recognized, properly worked-up, or even entirely misclassified. The successful recognition of an emerging outbreak must permit users of the system to assess candidate patterns as well as confirmed ones.

Analyzing Gender Differences in In-Hospital Survival after Myocardial Infarction: The Importance of Considering Status at Admission, Severity and Missing Data

Karla Nobrega (1), Richard Davies (2), Jean-Marie Berthelot (1), Helen Johansen (1), and the CAMI Investigators
Statistics Canada (1)
Ottawa Hospital, Cardiology (2)

OBJECTIVES: The purpose of this study is to expand the analysis done by Rouleau et al by assessing the impact of missing data, status at admission and severity of the myocardial infarction on gender differences in in-hospital mortality.

METHODS: The Canadian Assessment of Myocardial Infarction (CAMI) Study collected data on 4,010 patients between July 1990 and June 1992. Patients fell into three sub-populations; those who were transferred from another institution (967 patients), those who were already present at the hospital for the treatment of another condition (164 patients), and patients who presented directly (2879). For this analysis, data were analyzed within each sub-population. Missing data were imputed using a hot deck donor imputation and were matched with age, gender and if the patient died in hospital. Killip class recorded is the highest Killip class that the patient attained. Since this can be confounded with treatment, a logistic regression was used to establish a proxy for the latent Killip class at entry, based upon variables at presentation. Cox proportional regression models were used to analyze gender differences for in-hospital survival adjusting for Killip class.

RESULTS: Status at admission, severity and missing data all influence gender differences in in-hospital survival for patients suffering a myocardial infarction. Severity of the infarction and missing data were directly related to gender. Women had a more severe infarction and therefore had more missing data.

CONCLUSION: Our results show that most of the gender differences are accounted for after adjusting for severity, status at admission and missing data.

A Two-Sample Method for Analyzing Combined Samples of Correlated and Uncorrelated Data

Stephen W. Looney (1) and Peter W. Jones (2)

Department of Family and Community Medicine, University of Louisville School of Medicine (1)

Department of Mathematics, Keele University (2)

OBJECTIVES: To develop statistical methods for analyzing two-sample data which consist of some observations that are correlated and others that are uncorrelated. Typically, such data will consist of one subsample in which the observations for Treatment 1 and Treatment 2 are independent of each other, and another subsample which consists of paired observations taken on the same subjects under both treatments.

METHODS: The proposed test procedures are developed using asymptotic results and bootstrapping is used to perform the inference for small-samples. The methods are evaluated using simulation and are illustrated on a published data set.

RESULTS: The proposed methods and existing methods can give quite different results for a particular data set, as illustrated by the example. The simulation results indicate that the proposed methods can provide substantial improvement in control of Type I error rate and power when compared with existing methods.

CONCLUSION: Statistical workers who must analyze two-sample data that consist of a mixture of correlated and uncorrelated data should consider using the methods proposed in this presentation, as opposed to the more standard methods of analysis.

An Evaluation of Aberration Methods for Detecting Outbreaks in Public Health Surveillance Data

Lori Hutwagner (1), William Thompson (2), Sam Groseclose (2), and David G Williamson (2)

Division of Public Health and Informatics, Epidemiology Program Office, Centers for Disease Control and Prevention (1)

Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention (2)

OBJECTIVES: Infectious disease surveillance data are used to determine when and how often unusual disease outbreaks or aberrations in distribution occur so control measures can be implemented. This paper reviews point source aberration detection methods published and in production to enhance outbreak detection and public health response.

METHODS: We apply five commonly used outbreak detection methods to several disease outcomes under surveillance. The five methods will be characterized in terms of performance with disease outcomes that vary in both mean frequencies and seasonal variation. A comparison of how the different methods incorporate and accommodate historical trends is presented including comparisons regarding period and amount of historical data used, and how previous aberrations are modeled.

RESULTS: The results highlight complex issues surrounding outbreak detection in public health. All outbreak detection methods reduced the time necessary to interpret surveillance data.

CONCLUSION: Estimates of sensitivity and specificity for each algorithm were difficult to compare across methods because no gold standard has been developed for defining outbreaks and definition of outbreaks varies by disease condition and population under surveillance. Disease frequency and seasonality cause certain outbreak detection methods to perform better than other methods.

Soap Operas, Syndicated Market Research Data Bases, and Public Health: Statistical Analysis of Audience Data For Health Communication Planning

W.E. Pollard (1), I.J. Williams (2), and V. Beck (2)

Division of Health Communications, Office of the Director, Centers for Disease Control and Prevention (1)
Harvard School of Public Health (2)

OBJECTIVES: Understanding one's audience is an essential component in developing health communication for disease prevention and health promotion. Syndicated market research data bases are important tools for analysis of audiences. These data bases are widely used in the commercial sector to develop messages to promote products and services to potential customers. They contain proprietary and public information on sociodemographic characteristics, consumer behavior, lifestyle activities, and media habits of potential customers, and are available through licensing and contractual agreements. The purpose of this presentation is to report how analysis of such data can be used in health communication planning. In particular, application in the CDC Office of Communication's entertainment-education efforts with health messages for television shows is discussed.

METHODS: The analyses are based on two sets of syndicated market research data. The first is the Claritas PRIZM lifestyle segmentation system containing a large integrated set of U.S. census data, geographic information system (GIS) data, and market research data (including television viewing data), into which epidemiological data can be imported to examine the implications for communication. The second is data from the Porter Novelli Healthstyles survey, which is a national consumer mail panel survey concerning health characteristics, attitudes, and behaviors.

RESULTS: A number of population segments that have appeared in audience analyses that have been conducted to identify at-risk and underserved groups for health communication planning using the Claritas PRIZM data are among those with the highest rates of soap opera viewing. Analysis of health information seeking items on the Healthstyles survey showed that many regular viewers of soap operas report learning about health from soap operas, and many report taking some action as a result. These analysis of this data is reviewed along with analysis of other Healthstyles data concerning health status and health attitudes. The implications for the CDC's entertainment-education program in working with writers and producers of soap operas are described.

CONCLUSION: The findings suggest that television soap operas can provide a critical health education service by providing accurate, timely information about disease, injury, and disability. Analysis of syndicated market research data was essential for understanding the audience and the various dimensions of the health communication issue. Some general aspects of the analysis and use of syndicated marketing data bases for data-driven health communication planning are reviewed.

Hotspotting a Graphics Object in SAS/AF Frame Entry

Felicita David

Health Services Research and Evaluation Branch, National Immunization Program, Centers for Disease Control and Prevention

OBJECTIVES: SAS/AF FRAME entry graphics object is a useful tool for constructing graphical, 'point-and-click' interfaces to a user's data. Hotspotting is viewing all information associated with the component selected by the user, in a graphics object. Although, the SAS/GRAPH Output object does not provide for hotspotting per se, within certain limitations, the object can be made to behave as if it had this feature.

METHODS: A graphics object reads a SAS dataset and dynamically creates a graphical representation of the data. In a FRAME entry, when the user clicks on a component of a graphics object, the `_Get_Value_` method for the graphics object will return a list that is automatically filled with information about that data point that was just selected by the user and this subsetting information can be accessed for reports. When the underlying data changes, the values in the list returned by `_Get_Value_` method will reflect those changes.

RESULTS: An example, using SAS 6.12 engine on a Windows 98 platform, will demonstrate the automatic display of all information associated with the selected data point, in the execution mode.

CONCLUSION: Hotspotting a graphics object would greatly enhance the functionality of frame entries. This basic approach could be used to customize almost any graphics style used to present data.

Adjustments for Non-telephone Bias in the National Immunization Survey and Other RDD Surveys

M. R. Frankel (1), K. P. Srinath (1), M. P. Battaglia (1), D. C. Hoaglin (1), P. Smith (2), R. A. Wright (3), and
M. Khare (3)

Abt Associates (1)

Centers for Disease Control and Prevention-NIP (2)

Office of Research and Methodology, National Center for Health Statistics, Centers for Disease Control and
Prevention (3)

OBJECTIVES: The National Immunization Survey (NIS) is a large random-digit- dialing survey of telephone households for estimating vaccination coverage rates of children between the ages of 19 and 35 months for the nation, the 50 states, and 28 urban areas. Because children living in households without telephone service are excluded from the survey, there is potential for bias in the estimates of vaccination coverage rates at the urban area, state, and national level. Valid and practical methods are sought to provide adjustments for this potential bias.

METHODS: Several methods have been developed to adjust for bias that may exist in vaccination coverage rates. One method, which has been used for several years, is based on vaccination rate differentials between telephone and non- telephone households in the Health Interview Survey (HIS). An alternative series of methods have been developed based on recent findings about "interruptions in telephone service" among a segment of US households.

RESULTS: We compare the vaccination coverage rates obtained using the different adjustment methods to those using no adjustment. We also report the results of a validation test of methods using the Health Interview Survey (HIS) as a population.

CONCLUSION: Our results show that the use "interruption in telephone service" methods provide a valid and practical way to adjust for non-telephone bias associated with the use of RDD telephone surveys.